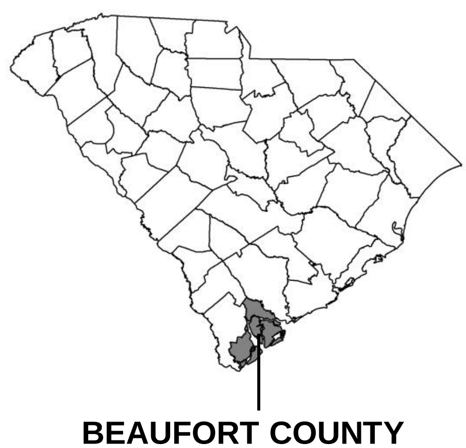
FLOOD INSURANCE STUDY

BEAUFORT COUNTY, SOUTH CAROLINA
AND INCORPORATED AREAS

VOLUME 1 OF 4

Community Name	Community Number
BEAUFORT, CITY OF	450026
BEAUFORT COUNTY (UNINCORPORATED AREAS)	450025
BLUFFTON, TOWN OF	450251
HARDEEVILLE, CITY OF	450113
HILTON HEAD ISLAND, TOWN OF	450250
PORT ROYAL, TOWN OF	450028
YEMASSEE, TOWN OF	450103



EFFECTIVE:
March 23, 2021

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
45013CV001A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. Please contact the Community Map repository for any additional data.

Selected Flood Insurance Rate Map panels for the community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross sections). In addition, former flood hazard zone designations have been changes as follows:

Old Zone	New Zone
A1 through A30	AE
V1 through V30	VE
B	X
C	X

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of the Flood Insurance Study at any time. In addition, FEMA may revise part of the Flood Insurance Study by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current Flood Insurance Study components.

Initial Countywide FIS Effective Date: March 23, 2021

TABLE OF CONTENTS
VOLUME 1 – MARCH 23, 2021

TABLE OF CONTENTS – continued
VOLUME 1 (continued)

Page

FIGURES

TABLES

EXHIBITS

VOLUME 2 – MARCH 23, 2021

EXHIBITS – (continued)

TABLE OF CONTENTS – continued
VOLUME 2 (continued)

EXHIBITS – (continued)

VOLUME 3 – MARCH 23 2021

EXHIBITS – (continued)

TABLE OF CONTENTS – continued
VOLUME 4 – MARCH 23, 2021

EXHIBITS – (continued)

FLOOD INSURANCE STUDY
BEAUFORT COUNTY, SOUTH CAROLINA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) revises and updates the previous FIS/Flood Insurance Rate Map (FIRM) for the geographic area of Beaufort County, South Carolina, including the Towns of Bluffton, Hilton Head Island, Port Royal, and Yemassee; the Cities of Beaufort, and Hardeeville; and the unincorporated areas of Beaufort County (hereinafter referred to collectively as Beaufort County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal regulations at 44 CFR, 60.3.

The Town of Yemassee is located in more than one county. The FIS and FIRM for Beaufort County will show the portions of the Town of Yemassee within Beaufort County. The remaining portions of this community lie within Hampton County.

The City of Hardeeville is located in more than one county. The FIS and FIRM for Beaufort County will show the portions of the City of Hardeeville within Beaufort County. The remaining portions of this community lie within Jasper County.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this FIS report are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This update includes an effort to combine all communities, as well as the unincorporated areas of Beaufort County, into a countywide FIS.

Table 1, “Summary of Flooding Sources Presented in Current Study”, provides a summary of the flooding sources within Beaufort County included in this current study, the completion date, study contractor, the contract number under which they were performed, and the communities affected by each.

Table 1: Summary of Flooding Sources Presented in Current Study

Flooding Sources	Completion Date	Study Contractor	Contract or Inter-Agency Agreement No.	Communities Affected
Atlantic Ocean	April 2015	AECOM	EMA-2004-CA-5022	Beaufort, City of; Beaufort County Unincorporated Areas; Bluffton, Town of; Hardeeville, City of; Hilton Head Island, Town of; Port Royal, Town of; Yemassee, Town of
New River Tributary 8	April 2013	AECOM	EMA-2004-CA-5022	Bluffton, Town of
Tributary to Unnamed Tributary 1	April 2013	AECOM	EMA-2004-CA-5022	Bluffton, Town of
Unnamed Tributary 1	April 2013	AECOM	EMA-2004-CA-5022	Bluffton, Town of

Base map information shown on the FIRM for Beaufort County was provided in digital format by the Beaufort County GIS Department.

The coordinate system used for producing this FIRM is NAD 1983 State Plane South Carolina FIPS 3900. Corner coordinates shown on the FIRM are in latitude and longitude referenced to the NAD 1983 State Plane South Carolina FIPS 3900, Lambert Conformal Conic projection, with geographic NAD 1983, Spheroid GRS 1980. Differences in the datum and spheroid used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on the FIRM.

1.3 Coordination

An initial Consultation Coordination Officer (CCO) meeting is held with representatives from the communities, FEMA, and the study contractor to explain the nature and purpose of a FIS and to identify the streams to be studied by detailed methods. A final CCO meeting is held with representatives from the communities, FEMA, and the study contractor to review the results of the study. The final CCO meeting is now referred to as a Preliminary DFIRM Community Coordination (PDCC) meeting.

The dates of the historical initial and final CCO meetings held for Beaufort County and the incorporated communities within its boundaries are shown in Table 2, “Historical CCO Meeting Dates”.

Table 2: Historical CCO Meeting Dates

Community Name	Initial CCO Date	Final CCO Date
Beaufort County (Unincorporated Areas)	November 8, 1983	November 19, 1985
Beaufort, City of	November 8, 1983	November 19, 1985
Bluffton, Town of	November 8, 1983	November 20, 1985
Hilton Head Island, Town of	November 8, 1983	November 20, 1985
Port Royal, Town of	November 8, 1983	November 19, 1985

For this countywide FIS, an initial CCO (Scoping) meeting was held on February 23, 2006, and attended by representatives of Watershed Concepts, a Division of Hayes, Seay, Mattern & Mattern (the study contractor), FEMA, the City of Beaufort, the Towns of Bluffton, Hilton Head Island, and Port Royal, Beaufort County, and South Carolina Department of Natural Resources (SCDNR). PDCC meetings were held on November 28-30, 2017 to review the results of the study. The meetings were attended by AECOM (the study contractor), FEMA, the City of Beaufort, the Towns of Bluffton, Hilton Head Island, and Port Royal, Beaufort County, and SCDNR.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Beaufort County, South Carolina, including the incorporated communities listed in Section 1.1. The scope and methods of this study were proposed to, and agreed upon, by FEMA, Beaufort County, and SCDNR.

The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction. The flooding sources studied by detailed methods are presented in Table 3, “Flooding Sources Studied by Detailed Methods”.

Table 3: Flooding Sources Studied by Detailed Methods

Flooding Source	Downstream Limit	Upstream Limit	Length (miles)
New River Tributary 8	Confluence with Unnamed Tributary to New River	0.8 miles upstream of Rephraim Cemetery Road	1.7
Tributary To Unnamed Tributary 1	Confluence with Unnamed Tributary 1	0.3 miles upstream of confluence with Unnamed Tributary 1	0.3
Unnamed Tributary 1	Confluence with Tributary To Cooper River	0.4 miles upstream of Big House Plantation Road	3.1

For this revision new coastal studies were performed along the entire coastline of Beaufort County, where the flooding source is the Atlantic Ocean.

This countywide FIS also incorporates the determination of letters issued by FEMA resulting in the Letters of Map Change as shown in Table 4, "Letters of Map Revision (LOMR) Incorporated into Current Study".

Table 4: Letters of Map Revision (LOMR) Incorporated into Current Study

Case Number	Flooding Sources	Communities Affected	Effective Date
08-04-4422P	Tributary D to New River	Beaufort County Unincorporated Areas	03/30/2009
14-04-5124P	Unnamed Tributary to New River	Bluffton, Town of	04/13/2015
15-04-2707P	Unnamed Tributary to New River	Bluffton, Town of	06/05/2015

2.2 Community Description

Beaufort County is located in the southeastern region of South Carolina, on the Atlantic Ocean. It is bordered by Hampton County to the north, Jasper County to the west and northwest, the Atlantic Ocean to the south, and Colleton County to the east and northeast. The county encompasses an area of 581 square miles.

The Atlantic Ocean coastline accounts for approximately 40 miles of the county's border. According to U.S. Census Bureau figures the population has increased from 120,937 in 2000 to 162,233 in 2010, a 34.1% increase (Reference 1).

The county is situated on a low coastal plain, with a significant portion of its area consisting of tidal marshes and swamps. About one-fifth of the county is covered by ocean tides on a daily or at least fairly frequent basis (Reference 2). Elevations range from sea level at the coast to approximately 49.1 feet North American Vertical Datum of 1988 (NAVD88) in the northern portion of the county.

The Combahee River, which forms the northern boundary of the county, and Coosawhatchie River, which empties into the tidal-influenced Broad River, have drainage areas extending far beyond the limits of Beaufort County. The New River, on the western boundary of the county, has a fairly large watershed. However, because of its low gradient, this watershed is largely affected by tidal conditions (Reference 2). Other streams within the county are chiefly tidal estuaries and include Beaufort River, Colleton River, Coosaw River, and Williman and Wimbee Creeks. The main openings to the Atlantic Ocean are Port Royal Sound and St. Helena Sound.

The majority of the land situated in the floodplains is undeveloped marshland with some residential, commercial, and industrial development. The principal residential and commercial developments are located along the coastline on Hilton Head and Fripp Islands and the Cities of Beaufort and Port Royal. The economy of the county depends principally on agriculture and tourism.

2.3 Principal Flood Problems

The primary factors contributing to flooding in Beaufort County are its exposure to Atlantic Ocean surges and the offshore bathymetry. The principal streams within the county have wide mouths and are bordered by extensive areas of low marsh. In addition, the terrain at the coast is generally too low to provide an effective barrier to flooding. Offshore depths are shallow for a long distance, which contributes to high Atlantic Ocean surges during hurricanes and tropical storms.

Beaufort County is subject to flooding caused by hurricanes and tropical storms. Records of hurricanes that have affected Beaufort County can be found as early as the 18th century. Major storms and hurricanes caused flooding in 1787, 1804, 1893, 1940, and 1959. The highest surge occurred during the hurricane of August 11, 1940, which caused flood heights up to 13.1 feet NAVD88, near Beaufort.

Although the records for the 18th century are limited and mostly descriptive, it is known that severe destruction and damage were cause by the hurricanes of 1752, 1769, and 1787.

The storm history of Beaufort County and its vicinity during the past two centuries is summarized below. Damage figures are determined in dollar values at the time of the storm. No attempt has been made to adjust these figures to current dollar values.

A severe hurricane moved inland on September 7, 1804, between Savannah, Georgia, and Charleston, South Carolina, causing immense damage on the coasts of these two states. The center of this storm skirted the coastline, passing over St. Simons Island, Georgia, just east of Savannah, over Beaufort, South Carolina, and then to the west of Charleston and Georgetown. This storm is said to have caused more than 500 drownings in South Carolina. The hurricane also caused major damage to the South Carolina economy. Historical notes contain no data on the heights of the storm surges or strength of the winds (Reference 3).

The major hurricane of August 7, 1854, approached the United States from the south-southeast after moving through the northern Bahamas. The southeasterly winds along the South Carolina coast drove the waters of the Atlantic Ocean into the bays and inlets that abound there, over some of the low-lying islands, and into the tidal lowlands that fringe all the rivers and streams (Reference 4). Edisto Island, near Charleston, suffered severely, as did Port Royal and the southern portions of Beaufort County.

A severe hurricane penetrated the Georgia and lower South Carolina coasts on August 27, 1893. An estimate of more than 1,000 people lost their lives on the coastal islands and in the lowlands between Tybee Island, Georgia, and Charleston, South Carolina (Reference 5). The highest surge in this storm was estimated to have ranged from 16.1 to 18.6 feet NAVD88 at Savannah Beach, Georgia (Reference 6). At Charleston, the surge was 8.0 feet NAVD88. Extensive property damage was caused along the lower South Carolina coasts.

October 1902

This tropical cyclone reached hurricane force in the Gulf of Mexico on October 6, moved inland into Alabama on October 10, and reached the extreme northern part of South Carolina on October 11. The storm was then extratropical. Conway received 4 to 8 inches of rainfall within an 11-hour period while Beaufort received 3.38 inches within 12 hours.

August 11, 1940

This hurricane entered the coast from the southeast, striking between Savannah, Georgia and Beaufort, South Carolina, at about 4 p.m. near Beaufort. The surge, estimated to have reached 13.3 feet NAVD88, overtopped the sea wall along the Beaufort River, destroyed or ripped every wharf from its piling, and flooded the entire business area of Beaufort to a depth of 2 to 3 feet. Eight people died on Ladies Island, near Beaufort. On Lemon Island, in the Broad River, the surge rose to 15.1 feet NAVD88. The outlying islands of St. Helena, Hilton Head, Daufuskie, and Pinckney suffered considerable damage from the storm surge with flood levels up to 9.1 feet NAVD88. Many small homes were destroyed or severely damaged. Wells, the only water supply, were flooded with salt water. Several hundred people were left homeless and 25 people died on these outlying islands. At Hunting Island, the beach line receded 75 to 100 feet, and several sandbars fronting the beach were washed away. Overall, this hurricane killed 34 people and caused damage estimated at $6.6 million (Reference 3).

October 12, 1944

This tropical cyclone appeared south of Cuba, moved slowly northward, passed across western Cuba, and entered the western coast of Florida late on October 18. This storm continued on a northerly course, with the center moving into the Atlantic, north of Jacksonville, Florida, and reentering the mainland near Beaufort late on October 19. The weakened storm then continued its northerly path through coastal South Carolina, producing heavy rains and squally weather over a large area. Storm damage was relatively light, estimated at about $200,000 to property and $150,000 to crops.

September 29, 1959 (Hurricane Gracie)

Hurricane Gracie moved inland at the Beaufort County coast about 11:30 a.m. on September 29, 1959. The center passed over St. Helena, about 10 miles east of Beaufort. Damage of disaster proportions occurred in the coastal region from Beaufort to Charleston, and considerable additional damage occurred in the Walterboro-Bambery sections. An enormous number of trees were felled, causing considerable random damage. There was a great deal of crop damage. A barometric pressure of 950 mb (28.06 inches) was reported at Beaufort. The total damage inflicted by the storm was estimated at $14 million. High-water marks, which were reported near Edisto Beach, South Carolina, ranged from 6.43 to 11.0 feet NAVD88.

September 11, 1960 (Hurricane Donna)

Hurricane Donna appeared off the South Carolina coast some 50 to 70 miles offshore from Beaufort. The center moved parallel to the coast north-northeast to northeastward with speeds varying from 20 to 30 miles per hour. The center of the hurricane left the vicinity of South Carolina during the night of September 11. Squalls and winds of gale force were registered all along the coast and in the eastern sections of the state, but significant damage and casualties caused by the hurricane itself were not reported (Reference 7).

2.4 Flood Protection Measures

Federal and State funded protection measures have not been employed in Beaufort County. However, scattered flood and erosion protection measures have been constructed on private properties, though these protection measures offer minimal protection, they provide no protection from the 1-percent-annual-chance event.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

For this countywide study, hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community. A summary of peak discharge-drainage area relationships for stream studied by detailed methods is shown in Table 5, “Summary of Discharges”.

Peak flood discharges for the 10-, 2-, 1-, and 0.2-percent-annual-chance storm events for all streams studied by detailed methods were determined using USGS regression equations for South Carolina, described in USGS Water-Resource Investigations Report (WRIR) 02-4140 (Reference 8). WRIR 02-4140 describes methods for determining peak flood discharges for watershed areas considered rural, or less than 10% impervious land cover. Since no areas were calculated with greater than 10% impervious, only rural regression equations were used. There was no applicable stream gage data available, therefore regression equation estimates were not adjusted based on gage data.

Table 5: Summary of Discharges

Flooding Source and Location	Drainage Area (mi.^{2})	Peak Discharges (cfs)				
		10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
NEW RIVER TRIBUTARY 8						
At confluence with Unnamed Tributary to New River	1.1	148	*	272	338	526
Approximately 130 feet downstream of Rephraim Cemetery Road	0.6	92	*	172	214	334
TRIBUTARY D TO NEW RIVER						
Just upstream of Sargent William Jasper Boulevard	0.3	76	*	123	148	212
TRIBUTARY TO UNNAMED TRIBUTARY 1						
At confluence with Unnamed Tributary 1	0.1	33	*	63	79	125
UNNAMED TRIBUTARY 1						
At confluence with Tributary To Cooper River	1.9	209	*	382	474	736
Approximately 1.2 miles upstream of confluence with Tributary To Cooper River	1.4	170	*	312	388	602
Approximately 1.3 miles downstream of Big House Plantation Road	0.8	117	*	216	269	420
Approximately 800 feet downstream of Big House Plantation Road	0.5	85	*	158	197	308
UNNAMED TRIBUTARY TO NEW RIVER						
At Rephraim Cemetery Road	1.83	*	*	*	697	*

* Data Not Available

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data Tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. Locations of selected cross-sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). Coastal transect profiles were drawn showing the computed water-surface elevations for coastal regions. Coastal flooding effects are shown on the Transect Profiles (Exhibit 2), and documented later in this FIS (Section 3.3). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM (Exhibit 3).

Roughness coefficients (Manning's "n") were estimated using USGS Digital Orthophoto Quarter Quads (DOQQ) for both channel and overbank areas. Table 6, "Summary of Roughness Coefficients" contains the channel and overbank "n" values for the streams studied by detailed methods.

Table 6: Summary of Roughness Coefficients

Flooding Source	Manning's 'n' Channel	Manning's 'n' Overbank
New River Tributary 8	0.050	0.150
Tributary To Unnamed Tributary 1	0.050	0.150
Unnamed Tributary 1	0.050	0.150

For this report streams which were studied were classified as detailed, based on their method of study. For detailed streams, a total of 9.4 miles and 4 hydraulic structures were studied. Hydraulic structures are defined as bridges, culverts, or dams.

Hydraulic cross-section geometries were obtained from Light Detection and Ranging (LiDAR) data. Hydraulic structures were field surveyed to obtain elevation data and structural geometry.

Water-surface elevations (WSELs) along each stream segment for the 10-, 2-, 1-, and 0.2-percent-annual-chance exceedance discharges for detailed methods were computed using the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center – River Analysis System (HEC-RAS) version 3.1.3 step-backwater computer program (Reference 9).

If applicable, a tie-in water-surface elevation was used as the starting condition for various hydraulic models. Otherwise, model starting conditions were set to normal depth starting slopes calculated from channel elevation values taken from the LiDAR data.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

3.3 Coastal Analyses

For most areas along rivers, streams, and small lakes, base flood elevations (BFEs) and floodplain boundaries are based on the amount of water expected to enter the area during a 1-percent-annual-chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves. Communities on or near ocean coasts face flood hazards caused by offshore seismic events as well as storm events.

Coastal BFEs are calculated as the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1-percent-annual-storm plus the additional flood hazard from overland wave effects such as storm-induced erosion, overland wave propagation, wave runup (Figure 1), and wave overtopping

Where they apply, coastal BFEs are calculated along transects extending from offshore to the limit of coastal flooding onshore. Results of these analyses are accurate until local topography, vegetation, or development type and density within the community undergoes major changes.

Figure 1: Wave Runup Transect Schematic

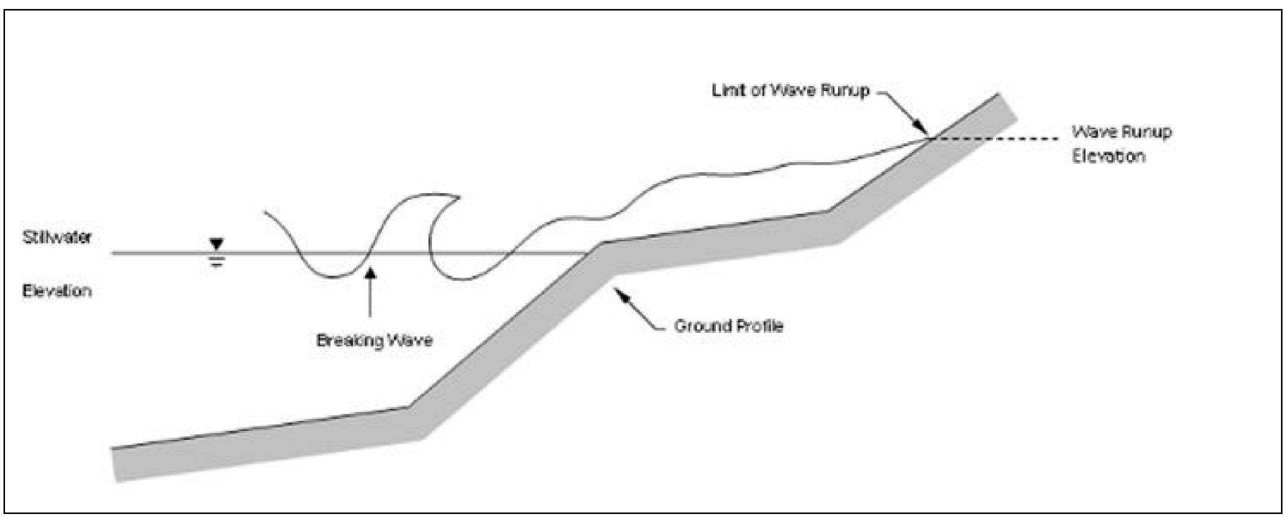
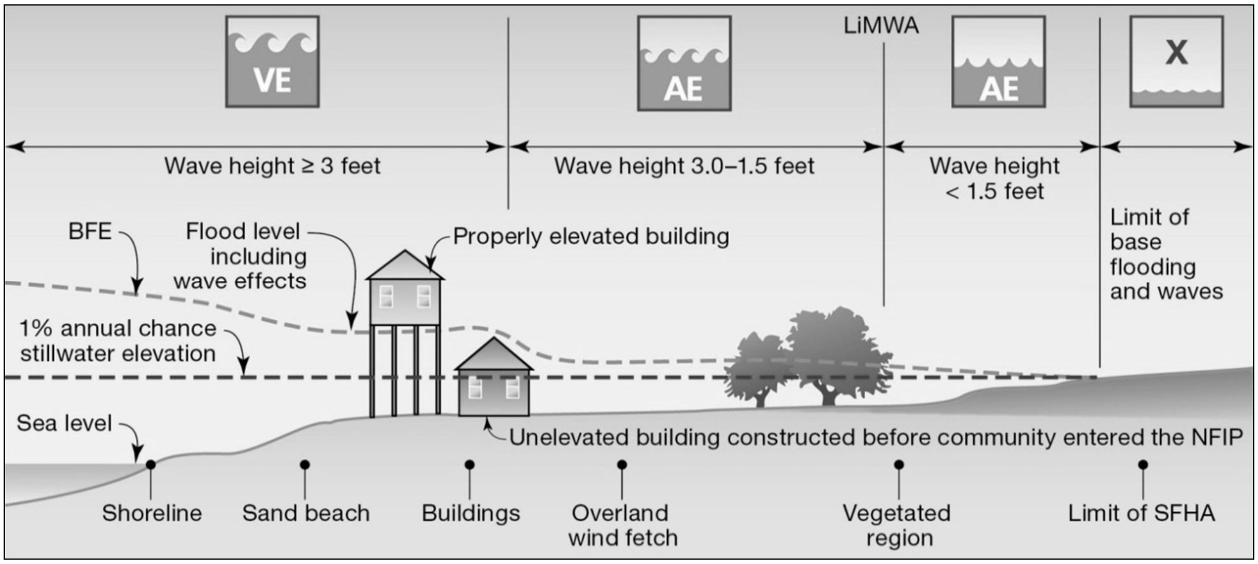


Figure 2, “Coastal Transect Schematic,” illustrates the relationship between the BFE, the 1-percent-annual-chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE areas in an area without a Primary Frontal Dune (PFD) subject to overland wave propagation. This figure also illustrates energy dissipation and regeneration of a wave as it moves inland, as well as the Limit of Moderate Wave Action (LiMWA).

Figure 2: Coastal Transect Schematic



For areas subject to flooding directly from the Atlantic Ocean, flood estimates were derived by simulating a large number of storm events using a coupling of two-dimensional (2D) hydrodynamic and wave models (e.g., the ADCIRC – Advanced CIRCulation model and the SWAN – Simulating Waves Nearshore model).

Underwater depths and land heights for the unstructured model grid were obtained from USACE and NOAA bathymetric survey datasets, bathymetric Digital Elevation Models (DEMs), and numerous sources of high-resolution LiDAR data. Topographic data was supplemented with USGS DEMs where LiDAR data was not available.

From ADCIRC + SWAN modeling simulations, the Joint Probability Method with Optimal Sampling (JPM-OS), developed by Resio (Reference 10) and Toro et al. (Reference 11 & 12), was applied to compute stillwater elevations (SWELs), including both the storm surge as well as the wave setup component. This statistical analysis resulted in an updated storm surge analysis of the entire South Carolina coast for the low frequency (2-, 1-, and 0.2-percent-annual-chance) events. Within coastal counties surrounding Beaufort County, 1-percent-annual-chance SWELs ranged from approximately 4.7 feet to 11.9 feet, referenced to the North American Vertical Datum of 1988 (NAVD88). The 0.2-percent-annual-chance SWELs ranged from approximately 13.5 feet to 16.5

feet, referenced to the NAVD88. Stillwater elevations at the open coast were generally higher than those values moving inland towards the study area.

High frequency (the 50-, 20-, 10-, and 4-percent-annual-chance) events were computed using L-moments type regional frequency analyses. L-moments were used to fit parametric extreme value probability distributions to annual maximum water levels recorded at tide gages along the Atlantic Coast of North Carolina, South Carolina, Georgia, and Florida. Regional frequency relationships were developed to predict the high frequency SWELs for the entire South Carolina coast.

The following subsections provide summaries of how each coastal process was considered for this FIS report. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation. Table 7, "Summary of Coastal Analyses", summarizes the methods and/or models used for the referenced coastal analyses.

Table 7: Summary of Coastal Analyses

Flooding Source	Study Limits		Hazard Evaluated	Model or Method Used	Date Analysis was Completed
	From	To			
Atlantic Ocean	Entire coastline of Beaufort County	Entire coastline of Beaufort County	Storm Climatology Statistical Analysis	JPM-OS	04/01/2012
Atlantic Ocean	Entire coastline of Beaufort County	Entire coastline of Beaufort County	Storm Surge including Regional Wave Setup	ADCIRC + SWAN	11/01/2013
Atlantic Ocean	Entire coastline of Beaufort County	Entire coastline of Beaufort County	Stillwater Frequency Analyses	Regional Frequency Analysis	11/01/2013
Atlantic Ocean	Entire coastline of Beaufort County	Entire coastline of Beaufort County	Dune Erosion	FEMA's Erosion Assessment	01/22/2016
Atlantic Ocean	Entire coastline of Beaufort County	Entire coastline of Beaufort County	Overland Wave Propagation	WHAFIS	01/22/2016
Atlantic Ocean	Entire coastline of Beaufort County	Entire coastline of Beaufort County	Wave Runup	RUNUP 2.0 /TAW	01/22/2016

Stillwater Elevations

The stillwater elevations (i.e., storm surge plus wave setup) for the 1-percent-annual-chance event were determined for areas subject to coastal flooding. The models and methods that were used to determine storm surge and wave setup are listed in Table 7. The statistical analysis used to determine the 2-, 1-, and 0.2-percent-annual-chance SWEL was detailed earlier in Section 3.2. The stillwater elevation that was used for each transect in coastal analyses is shown in Table 9, "Coastal Transect Parameters".

Tidal gages can be used instead of historic records of storms when the available tidal gage record for the area represents both the astronomical tide component and the storm surge component. Table 8, "Tide Gage Analysis Specifics", provides the gage name, gage identifier, managing agency, gage type, start date, end date, and statistical methodology applied to gages nearest to the study area that were used to determine the stillwater elevations. For areas between gages, stillwater elevations for selected recurrence intervals were estimated by interpolating between gages.

Table 8: Tide Gage Analysis Specifics

Gage Name	Managing Agency of Tide Gage Record	Gage Type	Start Date	End Date	Statistical Methodology
Duck, NC - 8651370	NOAA	Tide	1977	Present	L-moments, Generalized Logistic
Oregon Inlet, NC - 8652587	NOAA	Tide	1974	Present	L-moments, Generalized Logistic
Cape Hatteras Pier, NC - 8654400	NOAA	Tide	1973	2003	L-moments, Generalized Logistic
Beaufort, NC - 8656483	NOAA	Tide	1964	Present	L-moments, Generalized Logistic
Wilmington, NC - 8658120	NOAA	Tide	1908	Present	L-moments, Generalized Logistic
Springmaid Pier, SC - 8662245	NOAA	Tide	1976	Present	L-moments, Generalized Logistic
Charleston, SC - 8665530	NOAA	Tide	1899	Present	L-moments, Generalized Logistic
Fort Pulaski, GA - 8670870	NOAA	Tide	1935	Present	L-moments, Generalized Logistic
Fernandina Beach, FL - 8720030	NOAA	Tide	1898	Present	L-moments, Generalized Logistic
Mayport Ferry Depot, FL - 8720220	NOAA	Tide	1928	2008	L-moments, Generalized Logistic

Wave Setup Analysis

Wave setup was computed during the storm surge modeling through the methods and models listed in Table 7 and included in the frequency analysis for the determination of the total stillwater elevations.

Starting Wave Conditions

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is based on the ADCIRC+SWAN coupled model. Within this model, the SWAN component develops the spectral offshore and nearshore waves, which develop wave radiation stress gradients that produce wave-induced water level fluctuations near the coast. For each 2D model node, wave statistics were designated. SWAN modeling results of the significant wave height (H_{mo}) and peak wave period (T_p) were produced at each node contained in the ADCIRC grid based on a selection of wave conditions corresponding to modeled storms with the desired recurrence interval. These results provided valuable information on the wave conditions that can be expected to occur during the types of extreme storm events that would produce storm surge elevations with 1- and 0.2-percent-annual-chance probabilities of occurrence. The results from the JPM-OS ADCIRC + SWAN modeling were used to develop starting wave conditions for the transect-based wave hazard analyses.

Coastal Erosion

A single storm episode can cause extensive erosion in coastal areas. Storm-induced erosion was evaluated to determine the modification to existing topography that is expected to be associated with flooding events. For open coast transects where a distinguishable PFD could be identified, erosion was evaluated using the method listed in Table 7. FEMA-prescribed dune geometries were implemented in all cases where it was reasonable to do so, as outlined in Section D.2.9 of the FEMA Guidelines and Specifications (Reference 13 & 14). The dune erosion process was applied based on the cross-sectional area of the dune reservoir. Dune reservoirs with an area less than 540 square feet were removed, whereas dune reservoirs with an area greater than 540 square feet were modified with dune retreat.

Wave Hazard Analyses

Overland wave hazards were evaluated to determine the combined effects of ground elevation, vegetation, and physical features on overland wave propagation, in accordance with the “Wave Height Analysis for Flood Insurance Studies” (Reference 15). These analyses were performed at representative transects along all shorelines for which waves were expected to be present during the floods of the selected recurrence intervals. The results of these analyses were used to determine elevations for the 1-percent-annual-chance flood.

Transect locations were chosen with consideration given to the physical land characteristics as well as development type and density so that they would closely represent conditions in their locality. Additional consideration was given to changes in the total stillwater elevation. Transects were spaced close together in areas of complex topography and dense development or where total stillwater elevations varied. In areas having more uniform characteristics, transects were spaced at larger intervals. Transects shown in Figure 3, "Transect Location Map," are also depicted on the FIRM. Table 9 provides the location, stillwater elevations, and starting wave conditions for each transect evaluated for overland wave hazards. In this table, "starting" indicates the parameter values offshore of the transect.

Wave Height Analysis

Wave height analyses were performed to determine wave heights and corresponding wave crest elevations for the areas inundated by coastal flooding and subject to overland wave propagation hazards. Refer to Figure 2, "Coastal Transect Schematic" for a schematic of a coastal transect evaluated for overland wave propagation hazards.

Wave heights and wave crest elevations were modeled using the methods and models listed in Table 7.

Wave Runup Analysis

Wave runup analyses were performed to determine the height and extent of runup beyond the limit of stillwater inundation for the 1-percent-annual-chance flood. Wave runup elevations were modeled using the methods and models listed in Table 7.

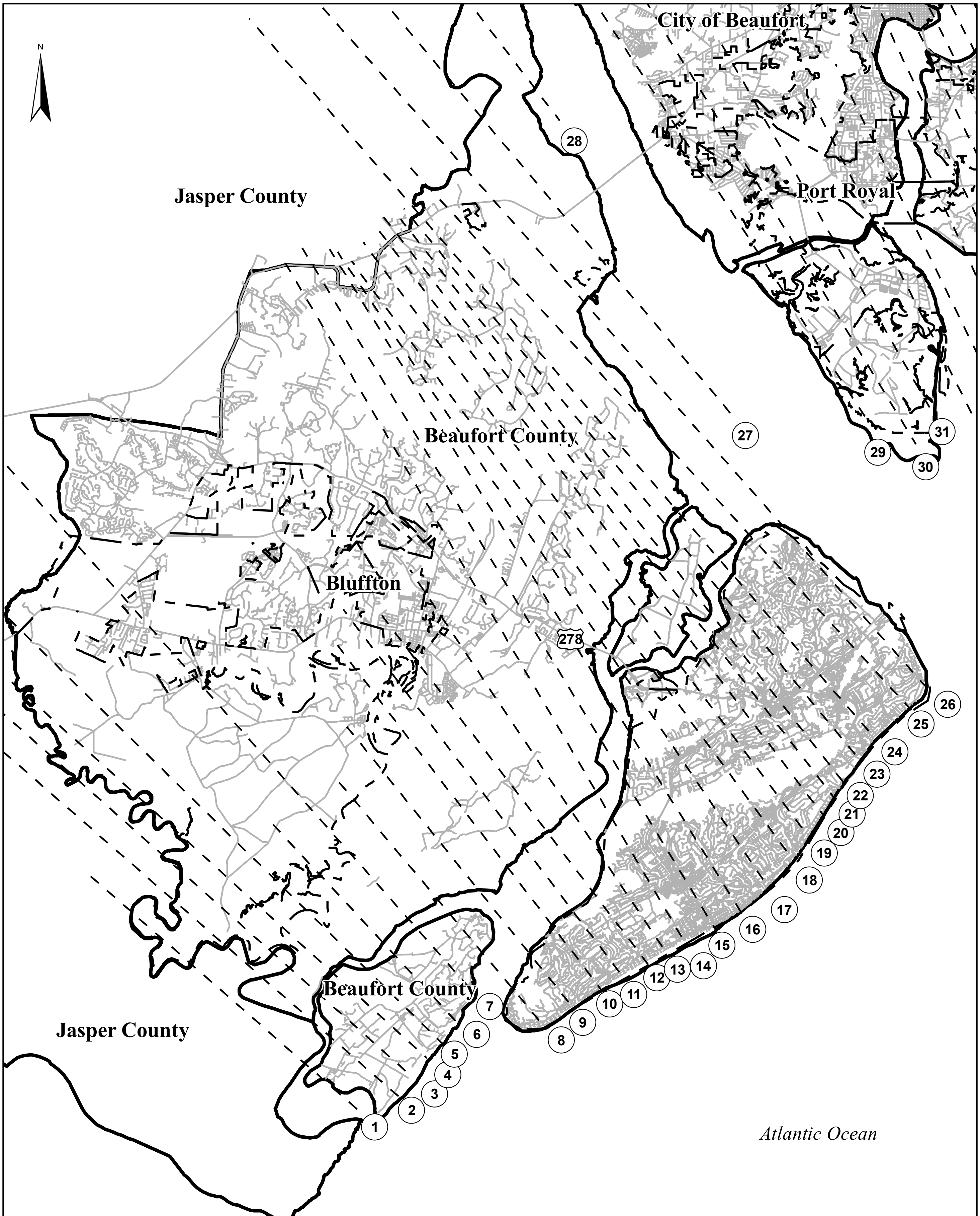


Figure 3

FEDERAL EMERGENCY MANAGMENT AGENCY
BEAUFORT COUNTY, SOUTH CAROLINA

Approximate Scale
0 1 2 4 6 Miles

TRANSECT LOCATION MAP

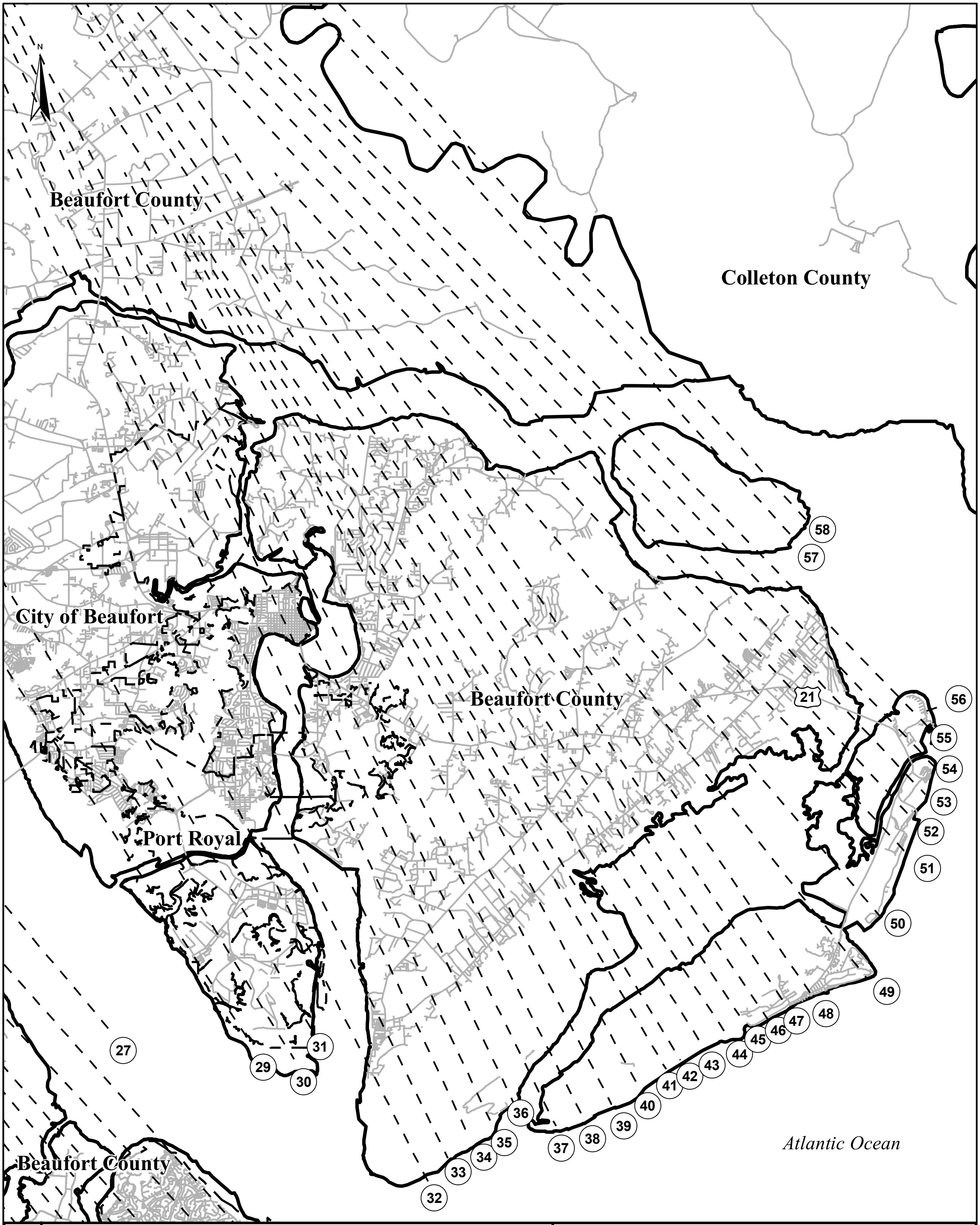


Figure 3

FEDERAL EMERGENCY MANAGMENT AGENCY
BEAUFORT COUNTY, SOUTH CAROLINA

Approximate Scale
0 1 2 4 6 Miles

TRANSECT LOCATION MAP

Table 9: Coastal Transect Parameters

Flood Source	Coastal Transect	Starting Wave Conditions for the 1%-Annual-Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10%-Annual-Chance	4%-Annual-Chance	2%-Annual-Chance	1%-Annual-Chance	0.2%-Annual-Chance
Atlantic Ocean	1	6.2	9	6.3 6.3 - 6.3	6.9 6.9 - 6.9	7.0 6.0 - 7.0	9.4 8.0 - 9.4	14.5 12.5 - 14.5
Atlantic Ocean	2	8.2	9	6.3 6.3 - 6.3	6.9 6.9 - 6.9	6.6 6.4 - 6.6	9.4 7.6 - 9.5	14.6 12.3 - 14.6
Atlantic Ocean	3	7.8	9	6.3 6.3 - 6.3	6.9 6.8 - 6.9	6.5 3.2 - 6.6	9.3 5.6 - 9.4	14.6 10.1 - 14.6
Atlantic Ocean	4	8.2	8	6.3 6.3 - 6.3	6.8 6.8 - 6.8	6.6 3.2 - 6.6	9.1 4.8 - 9.6	14.5 9.5 - 14.6
Atlantic Ocean	5	7.9	10	6.3 6.3 - 6.3	6.8 6.8 - 6.8	6.6 6.5 - 6.96	9.2 4.9 - 9.5	14.2 7.6 - 14.5
Atlantic Ocean	6	7.6	8	6.3 6.3 - 6.3	6.8 6.8 - 6.8	6.6 6.6 - 6.6	8.8 8.3 - 8.9	12.9 12.5 - 13.5
Atlantic Ocean	7	6.0	8	6.3 6.3 - 6.3	6.8 6.8 - 6.8	6.6 6.5 - 6.6	8.4 4.9 - 8.6	12.5 7.6 - 14.8
Atlantic Ocean	8	9.2	13	6.3 6.3 - 6.3	6.8 6.8 - 6.8	6.6 5.5 - 6.8	8.5 7.8 - 8.6	12.5 11.1 - 13.3
Atlantic Ocean	9	10.4	13	6.3 6.3 - 6.3	6.8 6.8 - 6.8	6.6 6.6 - 7.0	8.7 7.9 - 8.7	13.3 11.9 - 13.5
Atlantic Ocean	10	10.6	13	6.3 6.3 - 6.3	6.8 6.8 - 6.8	6.6 6.0 - 6.9	8.7 7.7 - 8.9	12.7 11.5 - 14.2
Atlantic Ocean	11	10.5	13	6.3 6.3 - 6.3	6.8 6.8 - 6.8	6.6 5.3 - 6.8	8.7 7.2 - 8.8	12.6 10.8 - 14.2
Atlantic Ocean	12	10.5	13	6.3 6.3 - 6.3	6.8 6.8 - 6.8	5.3 5.3 - 6.8	8.6 7.5 - 9.9	13.4 10.6 - 14.2

Table 9: Coastal Transect Parameters – continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1%-Annual-Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10%-Annual-Chance	4%-Annual-Chance	2%-Annual-Chance	1%-Annual-Chance	0.2%-Annual-Chance
Atlantic Ocean	13	10.5	13	6.3 6.3 - 6.3	6.8 6.8 - 6.8	6.6 6.5 - 6.8	8.7 7.1 - 8.7	13.3 10.2 - 13.4
Atlantic Ocean	14	10.4	13	6.2 6.2 - 6.3	6.8 6.8 - 6.8	6.5 6.5 - 7.8	8.5 7.0 - 10.6	13.2 10.4 - 16.4
Atlantic Ocean	15	9.9	13	6.2 6.2 - 6.2	6.8 6.8 - 6.8	6.1 6.1 - 8.0	8.6 6.6 - 10.5	13.0 10.0 - 16.2
Atlantic Ocean	16	10.0	13	6.2 6.2 - 6.2	6.8 6.8 - 6.8	6.0 6.0 - 7.9	8.6 7.0 - 10.3	12.8 10.0 - 16.1
Atlantic Ocean	17	10.2	13	6.2 6.2 - 6.2	6.8 6.8 - 6.8	5.9 5.9 - 7.7	8.7 6.6 - 10.3	12.9 10.3 - 16.0
Atlantic Ocean	18	9.8	13	6.2 6.2 - 6.2	6.7 6.7 - 6.8	5.9 5.9 - 7.6	8.9 6.1 - 10.3	11.9 9.8 - 15.9
Atlantic Ocean	19	9.6	13	6.2 6.2 - 6.2	6.7 6.7 - 6.7	5.9 5.9 - 7.5	9.0 7.2 - 10.1	14.1 11.2 - 15.7
Atlantic Ocean	20	10.1	13	6.2 6.2 - 6.2	6.7 6.7 - 6.7	6.4 5.7 - 7.5	9.0 6.7 - 10.0	14.1 11.3 - 15.7
Atlantic Ocean	21	10.2	13	6.2 6.2 - 6.2	6.7 6.7 - 6.7	5.9 5.8 - 7.5	9.0 6.8 – 9.9	14.2 11.4 - 15.7
Atlantic Ocean	22	9.9	13	6.2 6.2 - 6.2	6.7 6.7 - 6.7	5.9 5.3 - 7.4	9.0 6.6 - 9.8	14.2 11.5 - 15.3
Atlantic Ocean	23	9.8	13	6.2 6.2 - 6.2	6.7 6.7 - 6.7	7.0 6.8 - 7.3	9.0 7.2 - 9.8	12.7 11.0 - 15.3
Atlantic Ocean	24	10.2	13	6.2 6.2 - 6.2	6.7 6.7 - 6.7	7.0 6.6 - 7.3	8.9 7.3 - 9.7	13.8 11.0 - 15.5

Table 9: Coastal Transect Parameters – continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1%-Annual-Chance: Significant Wave Height H_s (ft)	Starting Wave Conditions for the 1%-Annual-Chance: Peak Wave Period T_p (sec)	Starting Stillwater Elevations (ft NAVD88) / Range of Stillwater Elevations (ft NAVD88): 10%-Annual-Chance	4%-Annual-Chance	2%-Annual-Chance	1%-Annual-Chance	0.2%-Annual-Chance
Atlantic Ocean	25	10.6	12	6.1 6.1 - 6.2	6.7 6.7 - 6.7	7.2 6.1 - 7.4	8.7 8.0 - 9.6	12.9 12.5 - 15.1
Atlantic Ocean	26	10.8	12	6.1 6.1 - 6.1	6.7 6.6 - 6.7	6.8 6.8 - 7.2	8.6 8.3 - 9.4	12.6 12.2 - 14.8
Atlantic Ocean	27	6.9	5	6.1 6.1 - 6.1	6.6 6.6 - 6.6	6.9 6.1 - 7.2	8.6 8.4 - 9.4	13.4 13.3 - 14.8
Atlantic Ocean	28	8.7	5	6.1 6.1 - 6.1	6.6 6.6 - 6.6	7.0 7.0 - 7.0	8.9 8.5 - 9.1	14.1 14.1 - 14.5
Atlantic Ocean	29	7.5	5	6.1 6.1 - 6.1	6.6 6.6 - 6.6	6.7 6.7 - 7.0	8.3 7.7 - 8.9	12.7 12.7 - 14.1
Atlantic Ocean	30	6.4	4	6.1 6.1 - 6.1	6.6 6.6 - 6.6	6.7 4.3 - 7.0	8.3 6.6 - 9.0	12.7 12.7 - 14.3
Atlantic Ocean	31	5.5	4	6.1 6.1 - 6.1	6.6 6.6 - 6.6	6.6 6.0 - 6.7	8.2 4.7 - 9.1	12.4 12.4 - 14.1
Atlantic Ocean	32	8.6	11	6.1 6.1 - 6.1	6.6 6.6 - 6.6	7.1 5.8 - 7.1	8.2 6.2 - 8.7	12.6 12.2 - 13.8
Atlantic Ocean	33	10.3	10	6.1 6.1 - 6.1	6.6 6.6 - 6.6	6.9 6.6 - 7.0	8.5 7.9 - 8.9	12.9 12.2 - 14.3
Atlantic Ocean	34	10.7	12	6.1 6.1 - 6.1	6.6 6.6 - 6.6	6.8 4.3 - 8.4	8.7 7.3 - 11.0	13.5 12.1 - 15.6
Atlantic Ocean	35	10.7	12	6.1 6.1 - 6.1	6.6 6.6 - 6.6	6.3 5.7 - 8.4	8.4 6.6 - 11.0	13.8 12.1 - 15.7
Atlantic Ocean	36	10.4	12	6.1 6.1 - 6.1	6.6 6.6 - 6.6	6.7 5.4 - 8.3	8.4 7.3 - 10.9	13.2 12.3 - 15.8

Table 9: Coastal Transect Parameters – continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1%-Annual-Chance: Significant Wave Height H_s (ft)	Starting Wave Conditions for the 1%-Annual-Chance: Peak Wave Period T_p (sec)	Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88): 10%-Annual-Chance	4%-Annual-Chance	2%-Annual-Chance	1%-Annual-Chance	0.2%-Annual-Chance
Atlantic Ocean	37	10.6	12	6.1 6.1 - 6.1	6.6 6.6 - 6.6	6.8 6.1 - 8.4	8.4 7.8 - 10.9	13.3 12.0 - 15.8
Atlantic Ocean	38	10.6	13	6.1 6.1 - 6.1	6.6 6.6 - 6.6	6.8 3.8 - 8.7	8.5 7.6 - 11.4	13.2 12.6 - 16.2
Atlantic Ocean	39	10.8	13	6.1 6.1 - 6.1	6.6 6.6 - 6.6	6.7 5.7 - 8.9	8.4 8.0 - 11.3	13.3 13.0 - 16.3
Atlantic Ocean	40	10.6	13	6.0 6.0 - 6.0	6.6 6.6 - 6.6	6.8 4.7 - 8.8	8.5 8.1 - 11.2	13.1 13.0 - 16.5
Atlantic Ocean	41	10.6	13	6.0 6.0 - 6.0	6.6 6.6 - 6.6	6.3 3.9 - 8.8	8.7 8.0 - 11.2	13.4 12.9 - 16.4
Atlantic Ocean	42	10.7	13	6.0 6.0 - 6.0	6.6 6.6 - 6.6	6.7 3.1 - 8.7	8.7 8.0 - 11.2	13.5 13.0 - 16.3
Atlantic Ocean	43	10.7	13	6.0 6.0 - 6.0	6.5 6.5 - 6.6	6.9 2.0 - 8.7	8.7 7.9 - 11.9	13.5 12.8 - 16.5
Atlantic Ocean	44	10.6	13	6.0 6.0 - 6.0	6.5 6.5 - 6.5	6.7 1.7 - 8.6	8.1 7.9 - 11.9	13.3 12.7 - 16.6
Atlantic Ocean	45	10.4	13	6.0 6.0 - 6.0	6.5 6.5 - 6.5	6.7 3.8 - 8.7	8.3 4.8 - 11.2	12.7 7.9 - 16.2
Atlantic Ocean	46	10.1	13	6.0 6.0 - 6.0	6.5 6.5 - 6.5	6.7 3.7 - 8.6	8.2 5.1 - 11.2	12.8 7.9 - 16.2
Atlantic Ocean	47	9.7	13	6.0 6.0 - 6.0	6.5 6.5 - 6.5	6.6 4.1 - 8.5	8.4 5.1 - 11.0	12.9 7.9 - 16.5
Atlantic Ocean	48	9.5	13	6.0 6.0 - 6.0	6.5 6.5 - 6.5	6.7 4.4 - 8.3	8.3 4.9 - 10.9	12.9 7.9 - 16.4

Table 9: Coastal Transect Parameters – continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1%-Annual-Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10%-Annual-Chance	4%-Annual-Chance	2%-Annual-Chance	1%-Annual-Chance	0.2%-Annual-Chance
Atlantic Ocean	49	10.2	13	6.0 6.0 - 6.0	6.5 6.5 - 6.5	7.0 6.5 - 8.4	8.5 8.3 - 10.5	13.0 13.0 - 16.2
Atlantic Ocean	50	10.2	13	6.0 6.0 - 6.0	6.5 6.5 - 6.5	6.3 4.9 - 8.7	9.2 8.7 - 11.0	14.1 13.2 - 16.3
Atlantic Ocean	51	10.6	13	5.9 5.9 - 5.9	6.5 6.5 - 6.5	7.7 5.7 - 8.7	9.8 8.7 - 11.9	15.1 12.7 - 16.0
Atlantic Ocean	52	9.8	13	5.9 5.9 - 5.9	6.4 6.4 - 6.4	7.6 5.6 - 8.8	9.7 7.4 - 10.7	15.1 8.0 - 16.1
Atlantic Ocean	53	9.9	13	5.9 5.9 - 5.9	6.4 6.4 - 6.4	7.7 4.4 - 8.2	10.0 4.9 - 10.4	15.3 8.0 - 16.2
Atlantic Ocean	54	9.9	13	5.9 5.8 - 5.9	6.4 6.3 - 6.4	7.6 4.4 - 9.0	9.6 4.7 - 10.3	15.0 8.7 - 16.0
Atlantic Ocean	55	7.8	13	5.9 5.8 - 5.9	6.4 6.3 - 6.4	7.6 3.8 - 7.9	9.8 4.7 - 10.2	14.8 9.5 - 15.3
Atlantic Ocean	56	7.7	13	5.9 5.9 - 5.9	6.4 6.4 - 6.4	7.5 6.6 - 7.6	9.6 9.4 - 9.7	14.6 14.5 - 14.7
Atlantic Ocean	57	6.8	5	5.8 5.8 - 5.8	6.3 6.3 - 6.3	7.8 4.1 - 8.2	10.1 5.8 - 11.3	15.3 9.5 - 15.3
Atlantic Ocean	58	7.2	5	5.8 5.8 - 5.8	6.3 6.3 - 6.3	7.7 4.4 - 7.7	10.1 6.3 - 10.1	15.2 10.0 - 15.2

3.4 Vertical Datum

All FIS reports and FIRM panels are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FIS reports and FIRM panels was the National Geodetic Vertical Datum of 1929 (NGVD29). With the finalization of the North American Vertical Datum of 1988 (NAVD88), many FIS reports and FIRM panels are being prepared using NAVD88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. In order to properly reference elevation values any NGVD29 elevations within Beaufort County must use a datum conversion factor of -0.923 feet from NGVD29 to NAVD88. It is important to note that adjacent communities may be referenced to NGVD29. This may result in differences in BFEs across the corporate limits between the communities.

For more information regarding conversion between the NGVD29 and NAVD88, see the FEMA publication entitled Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, (Reference 16), visit the National Geodetic Survey website at http://www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the archived project documentation associated with the FIS report and the FIRM panels for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks in the area, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at http://www.ngs.noaa.gov.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS provides 1-percent-annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1- and 0.2-percent-annual-chance floodplains; and a 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS, including Flood Profiles, Floodway Data Tables, and Summary of Stillwater Elevation Tables. Users should reference the data presented in the FIS as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood, also called the Special Flood Hazard Area (SFHA), for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community.

The 1- and 0.2-percent-annual-chance floodplain boundaries for streams studied by detailed methods are shown on the FIRM. On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special food hazard (Zones AE, and VE), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of moderate flood hazard. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For this countywide FIS the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross-section. Between cross-sections, the boundaries were interpolated from flood elevations determined at each cross-section using LiDAR data at a scale of 2 meters with a contour interval of 1 foot (Reference 17).

Flood insurance zones and BFEs including the wave effects were identified on each transect based on the results from the onshore wave hazard analyses. Between transects, elevations were interpolated using topographic maps, land-use and land-cover data, and knowledge of coastal flood processes to determine the aerial extent of flooding. Sources for topographic data are DEMs at a 50 foot by 50 foot grid cell size with a contour interval of 4 feet (Reference 18). Sources for bathymetric data are estuarine DEMs at 30 meter resolution, with a scale of 1 meter (Reference 19). Controlling features affecting the elevations were identified and considered in relation to their positions at a particular transect and their variation between transects.

Zone VE is subdivided into elevation zones and BFEs are provided on the FIRM.

The SFHA boundary indicates the limit of SFHAs shown on the FIRM as either "V" zones or "A" zones.

Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1-percent-annual-chance flood. These areas are referred to as coastal high hazard zones. The coastal high hazard zone is depicted on the FIRM panels as Zone VE. The USACE has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones. The one exception to the 3-foot wave criteria is where a primary frontal dune exists. The limit of the open coast high hazard area must extend landward to the primary frontal dune location, even if the controlling wave height decreases below 3 feet. The delineation of the landward toe of the primary frontal dune is based on the methodologies described in the FEMA guidance (Reference 13 & 14). In Beaufort County, the primary frontal dune extends along the open coast shoreline, except for at the inlet openings. Zone AE is depicted on the FIRM where the delineated flood hazard includes wave heights less than three feet.

Laboratory tests and field investigations have shown that wave heights as little as 1.5 feet can cause damage to and failure of typical Zone AE building construction. Wood-frame, light gage steel, or masonry walls on shallow footings or slabs are subject to damage when exposed to waves less than 3 feet in height. Other flood hazards associated with coastal waves (floating debris, high velocity flow, erosion, and scour) can also damage Zone AE construction.

To help community officials and property owners recognize this increased potential for damage due to wave action in Zone AE areas, a LiMWA boundary may be shown on the FIRM as an informational layer to assist coastal communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The location of the LiMWA relative to Zone VE and Zone AE is shown in Figure 2.

FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. If the LiMWA is shown on the FIRM, it is being provided by FEMA as information only. For communities that do adopt Zone VE building standards in the area defined by the LiMWA, additional Community Rating System (CRS) credits are available.

Table 10, "Summary of Coastal Transect Mapping Considerations", indicates the coastal analyses used for floodplain mapping and the criteria used to determine the inland limit of the open-coast Zone VE and the SFHA boundary at each transect.

Table 10: Summary of Coastal Transect Mapping Considerations

Coastal Transect	**Primary Frontal Dune (PFD) Identified**	**Wave Runup Analysis**	**Wave Height Analysis**	**Zone VE Limit**	**SFHA Boundary**
		Zone Designation and BFE (ft NAVD 88)	**Zone Designation and BFE (ft NAVD 88)**		
1		N/A	VE 11-14 AE 9-11	Wave Height	SWEL
2	ü	N/A	VE 10-14 AE 9-11	PFD	SWEL
3	ü	N/A	VE 10-14 AE 7-11	PFD	SWEL
4	ü	N/A	VE 10-14 AE 6-10	PFD	SWEL
5		N/A	VE 10-14 AE 5-10	Wave Height	SWEL
6	ü	N/A	VE 10-13 AE 8-10	PFD	SWEL
7	ü	N/A	VE 10-13 AE 5-10	PFD	SWEL
8	ü	VE 11 AO 1	VE 10-13 AE 8-10	PFD	Overtopping
9	ü	VE 11 AO 1	VE 11-13 AE 8-11	PFD	SWEL
10	ü	VE 11 AO 1	VE 11-13 AE 8-12	PFD	SWEL
11	ü	VE 11 AE 11 AO 1	VE 11-13 AE 7-11	Runup	Overtopping
12	ü	N/A	VE 11-13 AE 7-11	PFD	SWEL
13	ü	N/A	VE 11-13 AE 7-11	PFD	SWEL
14	ü	VE 11 AO 1	VE 10-13 AE 8-12	PFD	Overtopping
15	ü	VE 12 AE 12	VE 11-13 AE 7-12	PFD	SWEL

Table 10: Summary of Coastal Transect Mapping Considerations – continued

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
		Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
16	ü	VE 13 AE 13	VE 11-13 AE 7-12	PFD	SWEL
17	ü	VE 12 AO 1	VE 10-13 AE 7-12	PFD	SWEL
18	ü	N/A	VE 10-14 AE 7-12	PFD	SWEL
19	ü	N/A	VE 10-14 AE 7-12	PFD	SWEL
20	ü	VE 12 AO 1	VE 11-14 AE 8-12	PFD	SWEL
21	ü	VE 12 AE 12	VE 11-14 AE 8-12	Runup	SWEL
22	ü	N/A	VE 12-14 AE 8-12	PFD	SWEL
23	ü	N/A	VE 11-14 AE 7-12	PFD	SWEL
24	ü	N/A	VE 11-14 AE 8-12	PFD	SWEL
25	ü	VE 12 AE 12 AO 1	VE 11-13 AE 9-12	Runup	SWEL
26	ü	N/A	VE 11-13 AE 8-11	PFD	PFD
27	ü	N/A	VE 11-13 AE 9-10	Wave Height	SWEL
28		N/A	VE 12-13 AE 9-11	Wave Height	SWEL
29		N/A	VE 11-13 AE 8-11	Wave Height	SWEL
30		N/A	VE 9-12 AE 7-11	Wave Height	SWEL
31		N/A	VE 11-12 AE 5-10	Wave Height	SWEL
32	ü	N/A	VE 10-13 AE 7-10	PFD	SWEL
33	ü	N/A	VE 10-13 AE 8-10	PFD	SWEL

Table 10: Summary of Coastal Transect Mapping Considerations – continued

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis	Wave Height Analysis	Zone VE Limit	SFHA Boundary
		Zone Designation and BFE (ft NAVD 88)	Zone Designation and BFE (ft NAVD 88)		
34		N/A	VE 10-13 AE 8-12	Wave Height	SWEL
35		N/A	VE 10-14 AE 8-13	Wave Height	SWEL
36		N/A	VE 11-13 AE 8-13	Wave Height	SWEL
37	ü	N/A	VE 11-13 AE 8-13	PFD	SWEL
38		N/A	VE 11-14 AE 8-13	Wave Height	SWEL
39		N/A	VE 11-14 AE 8-13	Wave Height	SWEL
40		N/A	VE 11-13 AE 8-13	Wave Height	SWEL
41	ü	N/A	VE 11-15 AE 8-13	PFD	SWEL
42	ü	N/A	VE 11-15 AE 8-13	PFD	SWEL
43	ü	N/A	VE 11-15 AE 9-13	PFD	SWEL
44	ü	N/A	VE 10-15 AE 8-13	PFD	SWEL
45		N/A	VE 10-15 AE 5-13	Wave Height	SWEL
46	ü	VE 16 AO 2	VE 11-15 AE 5-13	PFD	SWEL
47	ü	VE 13 AO 1	VE 11-15 AE 5-13	PFD	SWEL
48	ü	N/A	VE 10-15 AE 5-13	PFD	SWEL
49		VE 13	VE 12-13 AE 8-12	Runup	SWEL
50	ü	N/A	VE 11-15 AE 8-12	PFD	SWEL
51	ü	N/A	VE 11-15 AE 9-12	PFD	SWEL

Table 10: Summary of Coastal Transect Mapping Considerations – continued

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis: Zone Designation and BFE (ft NAVD 88)	Wave Height Analysis: Zone Designation and BFE (ft NAVD 88)	Zone VE Limit	SFHA Boundary
52	ü	N/A	VE 11-15 AE 8-12	PFD	SWEL
53	ü	N/A	VE 11-15 AE 5-12	PFD	SWEL
54	ü	N/A	VE 11-15 AE 5-12	PFD	SWEL
55	ü	N/A	VE 12-15 AE 10-11	PFD	SWEL
56	ü	N/A	VE 12-15 AE 5-12	PFD	N/A
57		N/A	VE 12-15 AE 6-10	Wave Height	SWEL
58		N/A	VE 12-15 AE 6-10	Wave Height	N/A

A LiMWA boundary has also been added in coastal areas subject to wave action for use by local communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. To simplify representation, the LiMWA was continued immediately landward of the VE/AE boundary in areas where wave runup elevations dominate. Similarly, in areas where the Zone VE designation is based on the presence of a primary frontal dune or wave overtopping, the LiMWA was delineated immediately landward of the Zone VE/AE boundary.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional floodway studies.

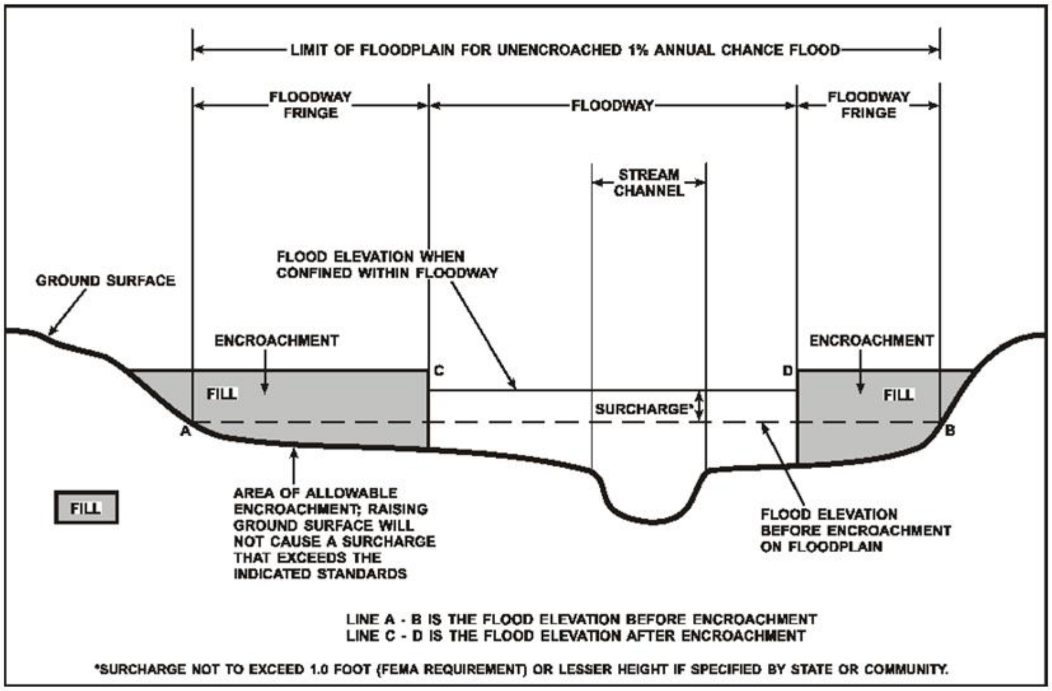
The floodways presented in this study were computed for certain stream segments on the basis of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at cross-sections. Between cross-sections, the floodway boundaries were interpolated. The results of the floodway computations for detailed studied stream are tabulated for selected cross-sections in Table 11, “Floodway Data”. The computed floodway is shown on the FIRM. In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either too close together or collinear, only the floodway boundary is shown.

Near the confluences of streams studied in detail, floodway computations were made without regard to flood elevations on the receiving water body. Therefore, “*Without Floodway*” elevations presented in Table 11, for certain downstream cross-sections of selected streams are lower than the regulatory flood elevations in that area, which must take into account the 1-percent-annual-chance flooding due to backwater from other sources.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. To reduce the risk of property damage in areas where the stream velocities are high, the community may wish to restrict development in areas outside the floodway. A listing of stream velocities at selected cross-sections is provided in Table 11.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1-percent-annual-chance flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

Figure 4: Floodway Schematic



LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	5,000	85	467	0.5	11.9	11.9	12.4	0.5
B	6,000	59	181	1.2	12.1	12.1	12.6	0.5
C	7,000	46	40	5.4	13.1	13.1	13.4	0.3
D	8,000	43	65	3.3	16.2	16.2	16.6	0.4
E	8,814	34	96	2.2	18.1	18.1	18.7	0.6

[1] Feet above confluence with Unnamed Tributary to New River

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

BEAUFORT COUNTY, SOUTH CAROLINA

AND INCORPORATED AREAS

FLOODWAY DATA

NEW RIVER TRIBUTARY 8

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	320	389	519	0.2	20.2	18.5[2]	19.0	0.5
B	1,728	293	1,141	0.1	20.2	18.6[2]	19.1	0.5

[1] Feet above confluence with Unnamed Tributary 1

[2] Elevation computed without consideration of backwater effects from Unnamed Tributary 1

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

BEAUFORT COUNTY, SOUTH CAROLINA

AND INCORPORATED AREAS

FLOODWAY DATA

TRIBUTARY TO UNNAMED TRIBUTARY 1

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	3,420	242	644	0.7	8.1	8.1	8.6	0.5
B	4,402	170	396	1.2	10.4	10.4	11.0	0.6
C	5,500	109	310	1.5	15.2	15.2	15.6	0.4
D	6,328	80	289	1.6	16.5	16.5	17.0	0.5
E	7,196	313	979	0.4	17.0	17.0	17.5	0.5
F	8,045	138	213	1.3	17.9	17.9	18.4	0.5
G	9,000	189	445	0.6	18.5	18.5	19.0	0.5
H	9,990	173	294	0.9	19.5	19.5	20.0	0.5
I	10,980	200	527	0.5	19.9	19.9	20.5	0.6
J	12,095	183	844	0.3	20.2	20.2	20.7	0.5
K	13,238	413	1,751	0.2	20.2	20.2	20.8	0.6
L	14,057	81	228	0.9	20.4	20.4	20.9	0.5
M	14,980	93	199	0.4	22.1	22.1	22.5	0.4
N	15,980	50	122	0.7	22.9	22.9	23.2	0.3
O	16,415	34	70	1.3	23.0	23.0	23.4	0.4

[1] Feet above confluence with Tributary to Cooper River

TABLE 11

FEDERAL EMERGENCY MANAGEMENT AGENCY

BEAUFORT COUNTY, SOUTH CAROLINA

AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED TRIBUTARY 1

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by detailed methods. In most instances, whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot base flood depths derived from the detailed hydraulic analyses are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1.0 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1.0 square mile, and areas protected from the 1-percent-annual-chance flood by levees. No BFEs or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use the zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways and the locations of selected cross-sections used in the hydraulic analyses and floodway computations.

The countywide FIRM presents flooding information for the entire geographic area of Beaufort County. Previously, FIRM panels were prepared for each identified flood-prone incorporated community and the unincorporated areas of the county. This countywide FIRM also includes flood hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 12, "Community Map History".

7.0 OTHER STUDIES

This is a multi-volume FIS. Each volume may be revised separately, in which case it supersedes the previously printed volume. Users should refer to the Notice to Flood Insurance Study Users in Volume 1 for the current effective date of each volume; volumes bearing these dates contain the most up-to-date flood hazard data.

FIS reports have been prepared for Colleton County, South Carolina, and Incorporated Areas, Hampton County, South Carolina, and Incorporated Areas, and Jasper County, South Carolina, Unincorporated Areas (Reference 20, 21, & 22).

A study is in progress for Colleton County, South Carolina, and Incorporated Areas (Reference 23). That report is in agreement with this study.

Because it is based on more up-to-date analyses, this FIS supersedes the previously printed FISs for Beaufort County, South Carolina, and Incorporated Areas: Unincorporated Areas, City of Beaufort, Town of Bluffton, and Town of Hilton Head Island (Reference 24, 25, 26, & 27).

Some flood related studies that are relevant to the study area include "Storm Tide Frequencies on the South Carolina Coast", "National Shoreline Study, Regional Inventory Report: South Atlantic-Gulf Region, Puerto Rico, and the Virgin Islands, Appendix A", and "Critical Analysis of Storm Surge and Wave Crest Elevation Along the South Carolina Shoreline" (Reference 28, 29, & 30).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Mitigation Division, Koger Center - Rutgers Building, 3003 Chamblee Tucker Road, Atlanta, Georgia 30341.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Beaufort, City of	June 28, 1974 September 5, 1975	—	May 2, 1977	September 5, 1984 September 29, 1986
Beaufort County (Unincorporated Areas)	September 30, 1977	—	September 30, 1977	October 1, 1983 December 4, 1984 September 29, 1986 January 17, 1991 November 4, 1992
Bluffton, Town of	December 18, 1986	—	December 18, 1986	
Hardeeville, City of	June 14, 1974	April 23, 1976 June 27, 1980	September 1, 1987	
Hilton Head Island, Town of	September 30, 1977	—	September 30, 1977	December 4, 1984 September 29, 1986
Port Royal, Town of	June 14, 1974 October 10, 1975	—	April 15, 1977	September 5, 1984 September 29, 1986
Yemassee, Town of	June 21, 1974	October 17, 1975	September 1, 1986	

TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

BEAUFORT COUNTY, SC

AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

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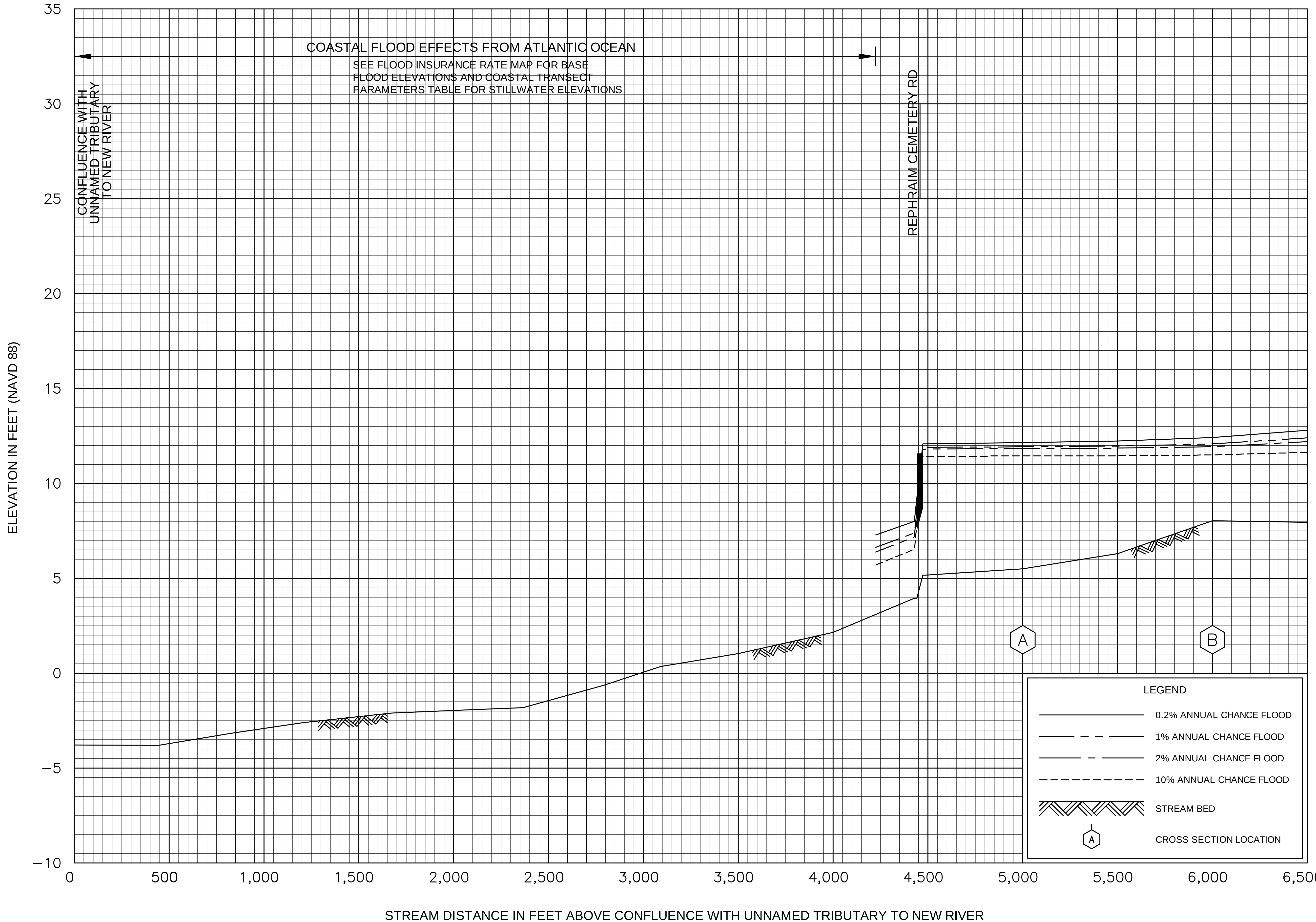

FLOOD PROFILES

NEW RIVER TRIBUTARY 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

BEAUFORT COUNTY, SC

AND INCORPORATED AREAS

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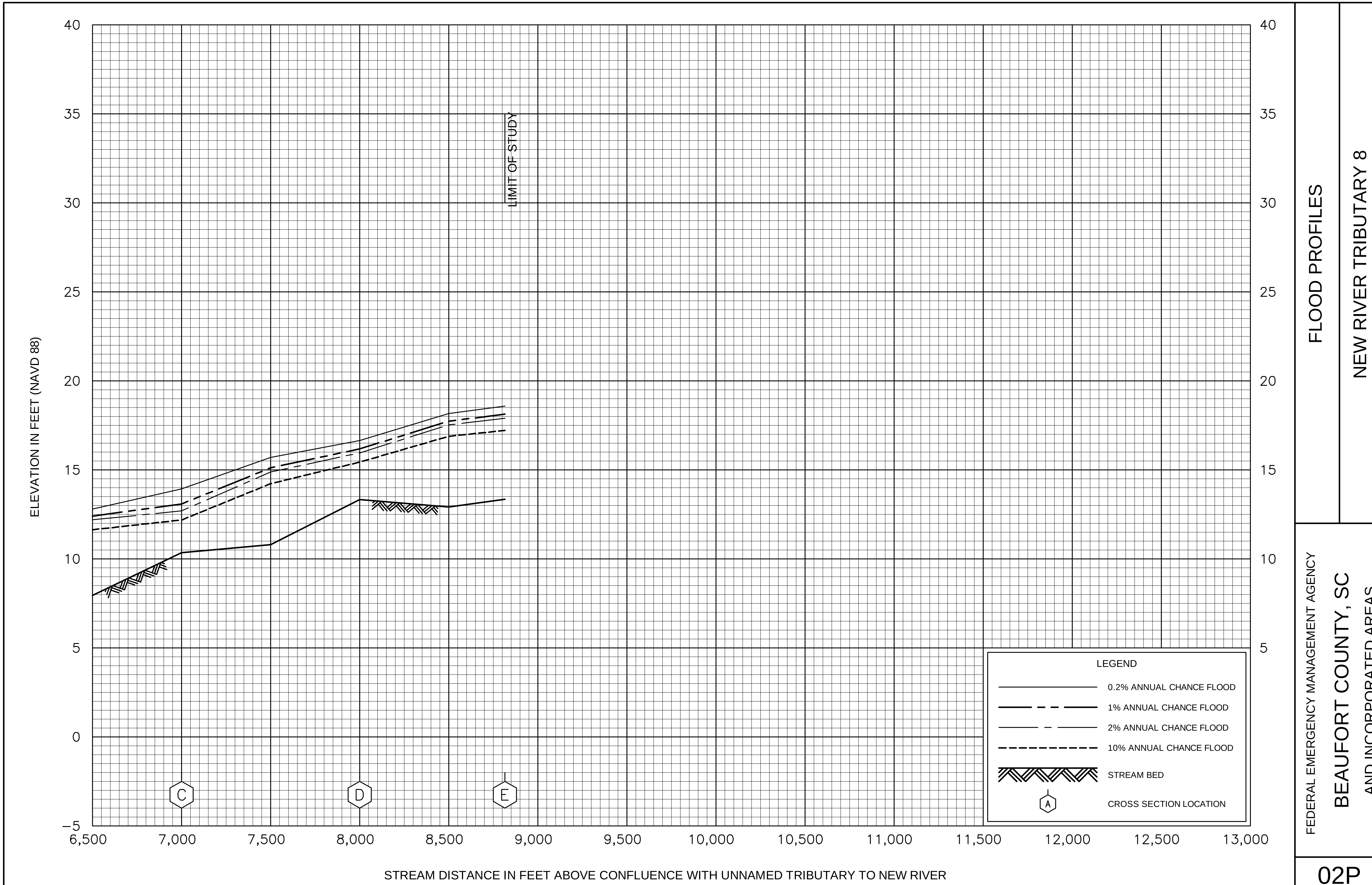
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20
15
10
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6,500
7,000
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STREAM BED
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CROSS SECTION LOCATION
STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH UNNAMED TRIBUTARY TO NEW RIVER
FLOOD PROFILES
NEW RIVER TRIBUTARY 8
FEDERAL EMERGENCY MANAGEMENT AGENCY
BEAUFORT COUNTY, SC
AND INCORPORATED AREAS
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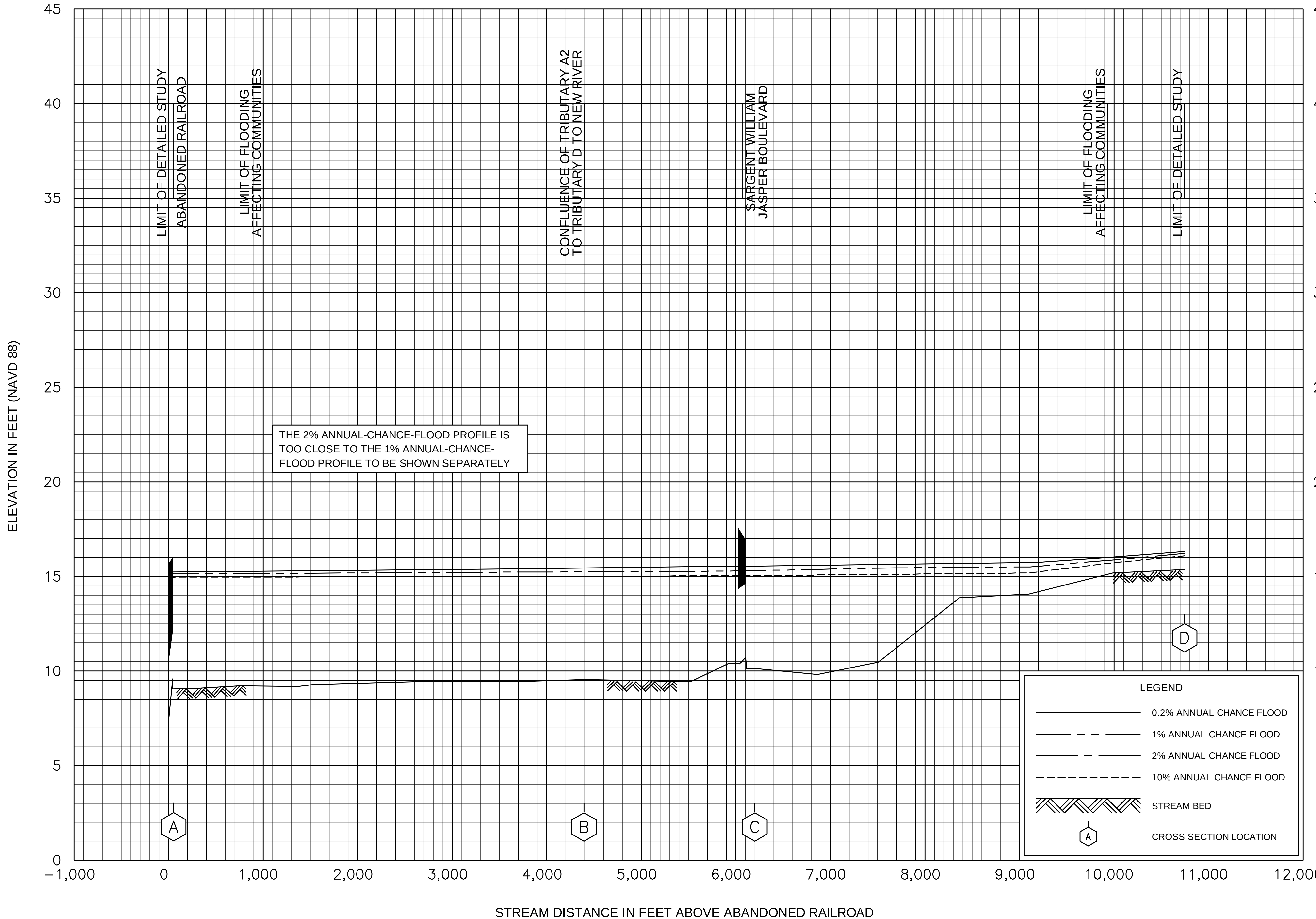

FLOOD PROFILES

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FEDERAL EMERGENCY MANAGEMENT AGENCY

BEAUFORT COUNTY, SC

AND INCORPORATED AREAS

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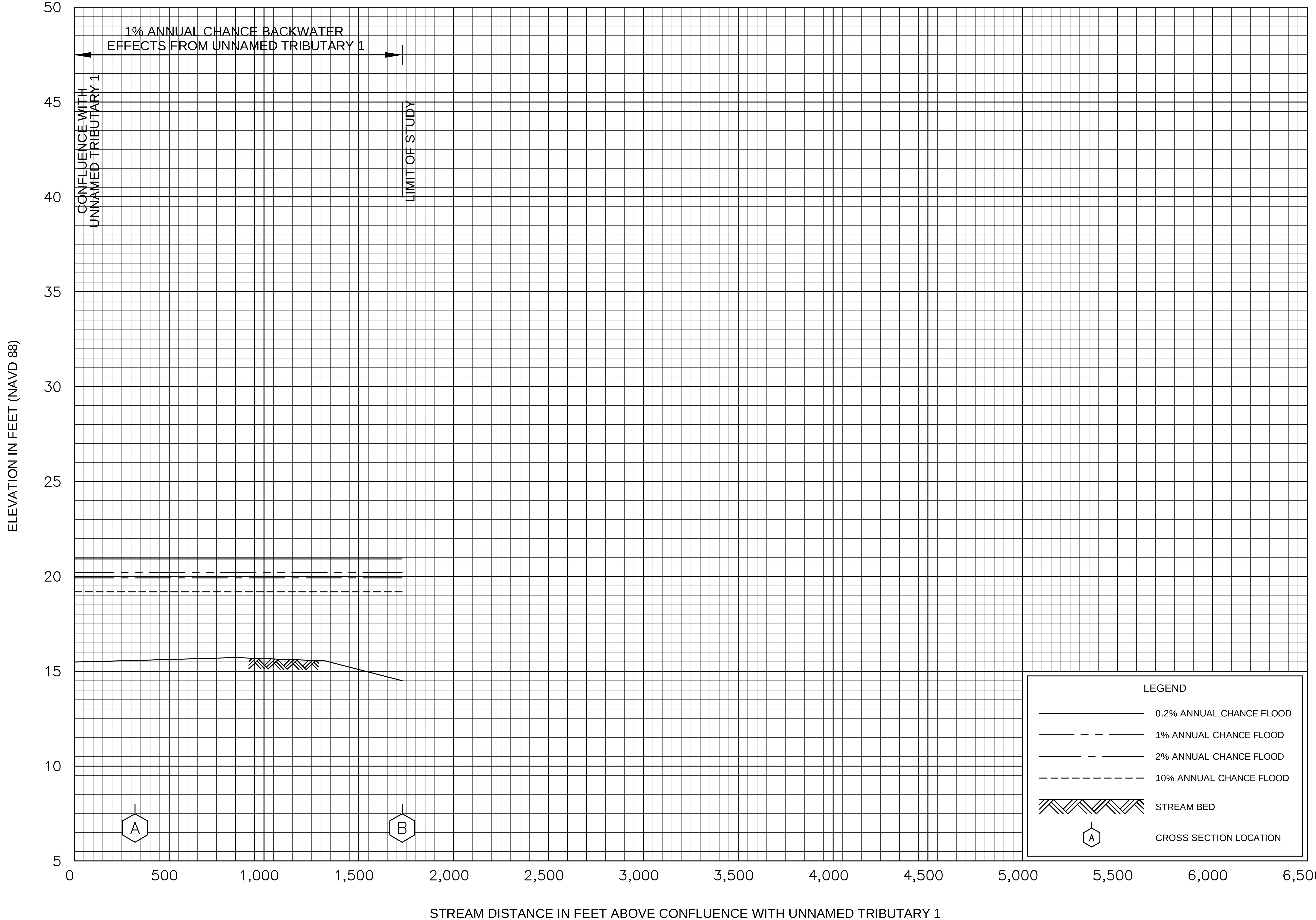


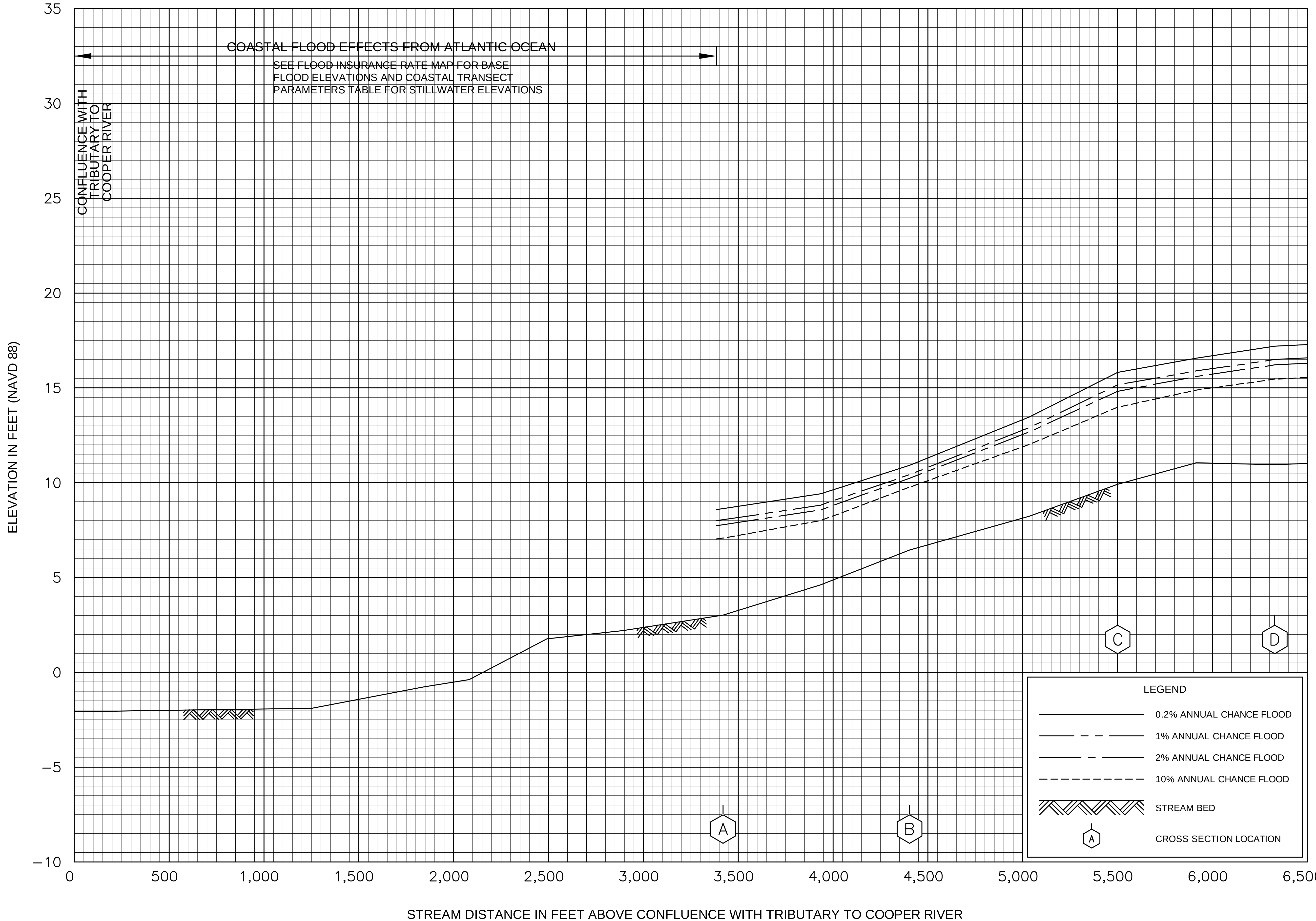
FLOOD PROFILES

TRIBUTARY TO UNNAMED TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BEAUFORT COUNTY, SC

AND INCORPORATED AREAS



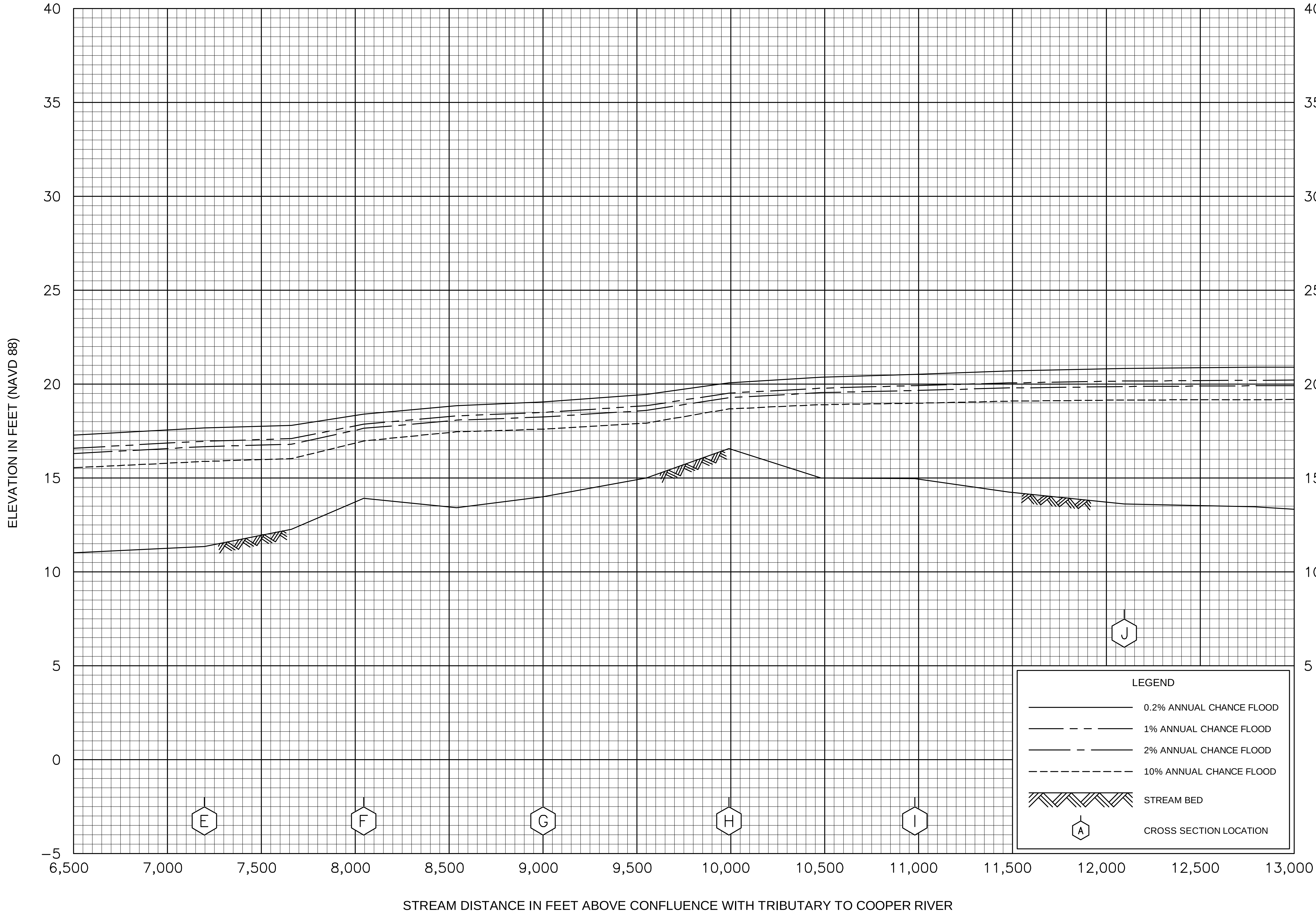
FLOOD PROFILES

UNNAMED TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BEAUFORT COUNTY, SC

AND INCORPORATED AREAS



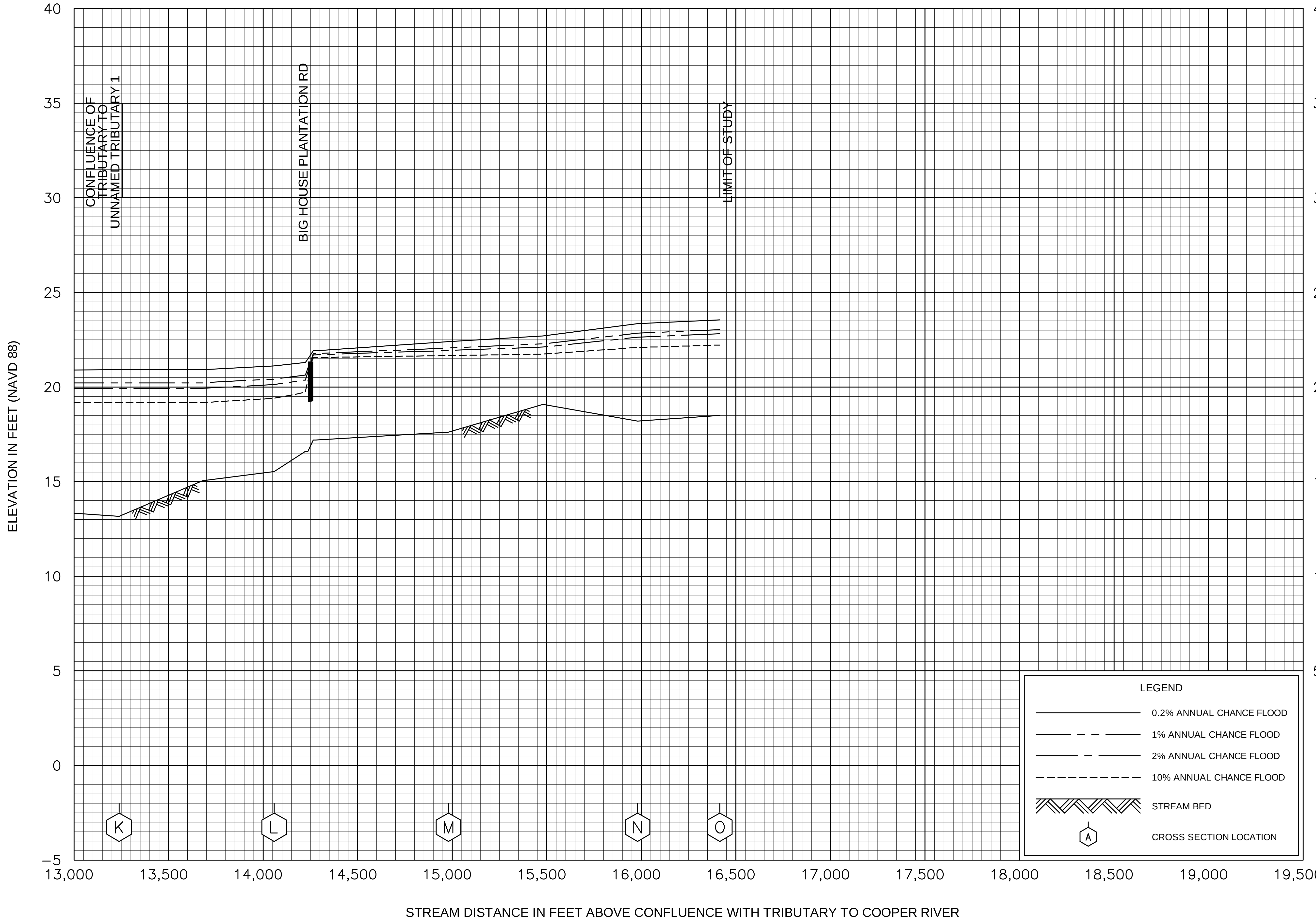
FLOOD PROFILES

UNNAMED TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BEAUFORT COUNTY, SC

AND INCORPORATED AREAS



FLOOD PROFILES

UNNAMED TRIBUTARY 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BEAUFORT COUNTY, SC

AND INCORPORATED AREAS

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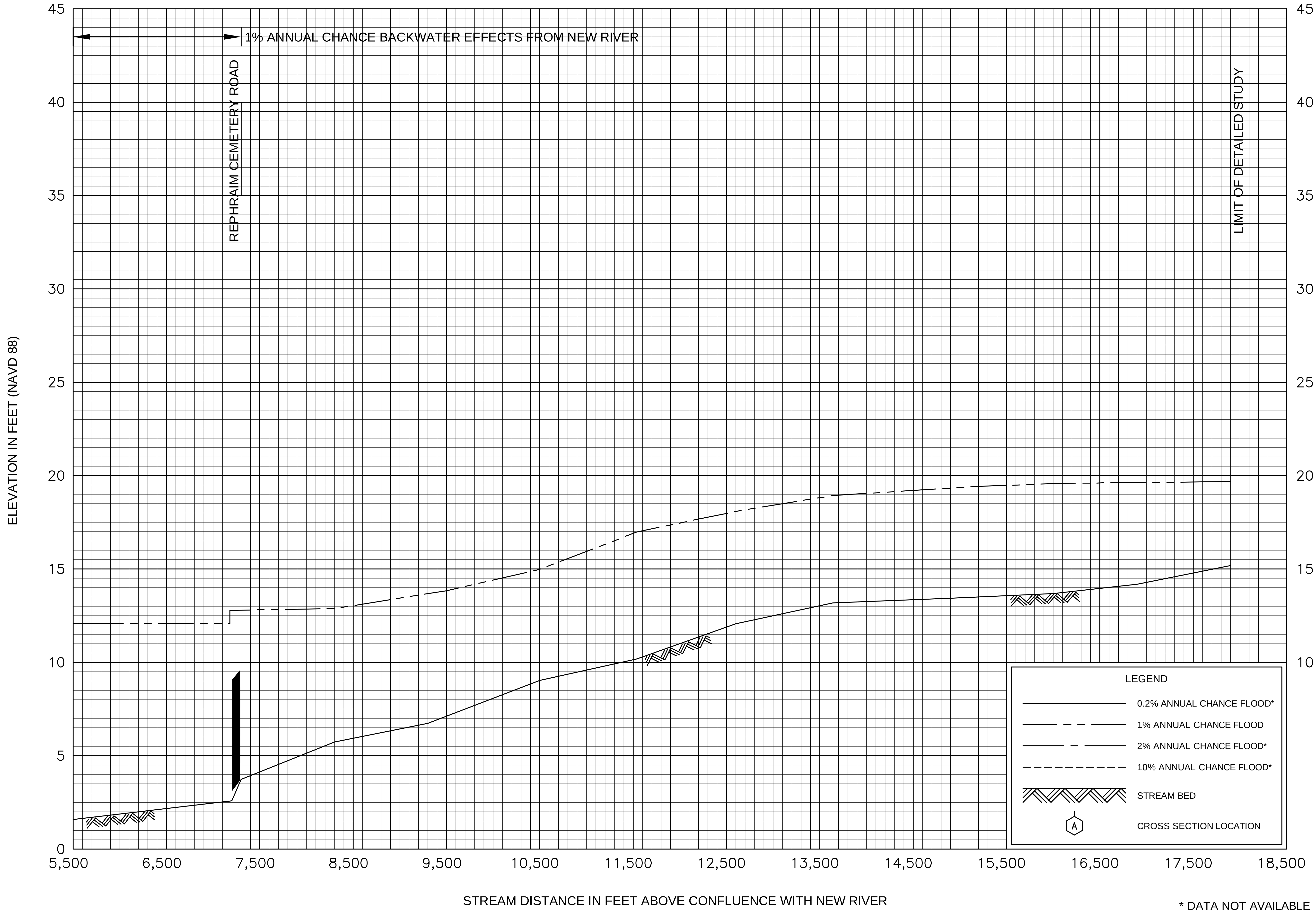

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FLOOD PROFILES

UNNAMED TRIBUTARY TO NEW RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BEAUFORT COUNTY, SC

AND INCORPORATED AREAS